



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Atty. Docket No.: 2551-026

Douglas M. BLAIR

Appln. No.: 09/881,234

Group Art Unit: 1631

Filing Date: June 14, 2001

Examiner: Smith, C.

For: **APPARATUS AND METHOD FOR PROVIDING SEQUENCE
DATABASE COMPARISON**

Commissioner for Patents
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OFFICE ACTION RESPONSE UNDER 37 C.F.R. §1.111

Sir:

Applicants respectfully requests entry of the following amendment and
reconsideration based on the accompanying remarks.

July 14, 2003

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Atty. Dckt. 2551-026

REMARKS

Claims 1-23 remain in the application. Paragraph 68 has been amended to correct the spelling of the word "subject." No new matter has been added.

Election/Restriction

The Office Action makes FINAL the requirement for an election of species.

Applicants hereby incorporate all the previous arguments filed November 25, 2002 and again traverse the election requirement as being improper under M.P.E.P. 803.02, which clearly states "[i]f the members of the Markush group are **sufficiently few in number or** so closely related that a search and examination of the entire claim can be made without serious burden, **the examiner must examine all claims on the merits, even though they are directed to independent and distinct inventions.** In such a case, **the examiner will not follow the procedure described below and will not require restriction.**" (Emphasis added)

Rejections - 35 USC 112

Claims 1-23 were rejected as being indefinite for the use of the abbreviations "CPU" and "ID" as well as for the use of the terms "efficient structure," "efficiently encoded representation of alignment," "BLAST," "seed point and sum-set membership," and "proteomic databases." Applicants traverse these rejections and submits that the claims, as originally filed, are definite.

In accordance with M.P.E.P. §2173.01, Applicant submits that a fundamental principle contained in 35 U.S.C. §112, second paragraph is that applicants are their own lexicographers. Applicant can define in the claims what he regards as his invention essentially in whatever terms he chooses so long as the terms are not used in ways that are contrary to accepted meanings in the art. Applicant may use functional language, alternative expressions, negative limitations, or any style of expression or format of claim which makes clear the boundaries of the subject matter for which protection is sought. As noted by the court in *In re Swinehart*, 439 F.2d 210, 160 USPQ 226 (CCPA 1971), a

claim may not be rejected solely because of the type of language used to define the subject matter for which patent protection is sought.

In accordance with M.P.E.P. §2173.02, Applicant submits that the Examiner's focus during examination of claims for compliance with the requirement for definiteness of 35 U.S.C. §112, second paragraph is whether the claim meets the threshold requirements of clarity and precision, not whether more suitable language or modes of expression are available. When the Examiner is satisfied that patentable subject matter is disclosed, and it is apparent to the examiner that the claims are directed to such patentable subject matter, he or she should allow claims which define the patentable subject matter with a reasonable degree of particularity and distinctness. *Some latitude in the manner of expression and the aptness of terms should be permitted even though the claim language is not as precise as the examiner might desire.* Examiners are encouraged to suggest claim language to applicants to improve the clarity or precision of the language used, *but should not reject claims or insist on their own preferences if other modes of expression selected by applicants satisfy the statutory requirement.*

The essential inquiry pertaining to this requirement is whether the claims set out and circumscribe a particular subject matter with a reasonable degree of clarity and particularity. Definiteness of claim language must be analyzed, not in a vacuum, but in light of:

- (A) The content of the particular application disclosure;
- (B) The teachings of the prior art; and
- (C) The claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made.

In the present case, the application disclosure discusses CPUs, IDs, and BLAST, and does not disclose central processing units, identifications, and **Basic Local Alignment Search Tool**, such that to amend the claims as suggested by the Examiner would possibly cause indefiniteness due to inconsistency between the specification disclosure and the claim language (see, e.g., M.P.E.P. §2173.03). Additionally, those of ordinary skill in the art readily understand what a CPU, an ID, and BLAST mean such that the terms define the patentable subject matter with a reasonable degree of particularity and distinctness.

With respect to the term "efficient structure," Applicants direct the Examiner's attention to paragraph 68, wherein the term is defined: "efficient structure, e.g. 2 bits per nucleotide with appropriate encoding, 5 bits per amino acid residue with appropriate encoding, etc."

With respect to the term "efficiently encoded representation of alignment," Applicants submit that one of ordinary skill in the art of bioinformatics would clearly understand the meaning of the entire term, "an efficiently encoded representation of alignment between said bounds corresponding to a high-scoring segment pair." Indeed, BLAST uses a specific format to represent alignment pairs.

With respect to the term "seed point and sum-set membership," Applicants submit that one of skill in the art readily understands the meaning of the term "seed" as a matching word/string and "sum" as a part of the scoring when using BLAST such that the claimed term is sufficiently clear to one of skill in the art.

With respect to the term "proteomic databases," Applicants submit both that (i) the inclusion of the term is proper since the election requirement is improper (as discussed above) and that (ii) the election is moot based on the allowability of the generic claims (as discussed below).

In view of the above-cited reasons, Applicants submit that claims 1-23 are definite and respectfully request reconsideration and withdrawal of the rejections.

Claim Rejections - 35 USC 103

Claims 1, 4, 6-7, 9-10, 12-13, 16, 18-21, and 23 were rejected as allegedly being obvious over Altschul et al. in view of Fujimiya et al., Anderson et al., Lincoln et al., and Matsumoto et al.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. (See M.P.E.P. Section 2143).

No Motivation to Combine

In the present case, none of these criteria have been met in the Office Action. First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the BLAST method of Altschul et al. or combine it with Fujimiya et al., Anderson et al., Lincoln et al., and Matsumoto et al.

The stated motivation to combine is wrought with errors and hindsight. On page 8 of the Office Action, it says: "A skilled artisan in the art would have been motivated to make improvements to a rapid homology retrieval program [Altschul et al.]...on various datasets in order to provide faster and more accurate access of the information to users [Fujimiya et al. and Matsumoto et al.]" However, the present invention is not to "faster and more accurate homology retrieval," but to comparisons of larger datasets with multiple CPUs having modest RAM.

Pages 8-9 continue with: "Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to test datasets [Anderson et al.] ...containing possible combinations [Fujimiya et al.]...using...BLAST [Altschul et al.]..., and speeding up the process using compressed files [Matsumoto et al.]...and looping the sequences analyzed [Lincoln et al.] ...with generated reports which could all be sent over a network of CPUs and databases in order to allow greater, faster, and efficient access to users of the homology information via methods and a computer system [Fujimiya et al. and Matsumoto et al.]."

However, the claimed invention does not concern and has no limitations to "test datasets" as in Anderson et al., but rather divides a comparison of datasets N and M into $n_N \times n_M$ tasks; the claimed invention does not speed "up the process using compressed files," but rather uses efficient data structures to lower the use of network bandwidth; the claimed invention has limitations to "looping the sequences analyzed" in claim 18, but also requires "looping through query sequences from said query data element to perform setup, preprocessing and table generation for each row of comparisons" that is not suggested; the present invention is not concerned with generating "reports which could all be sent over a network of CPUs and databases in order to allow greater, faster, and

efficient access to users of the homology information via methods and a computer system," but rather is drawn to tasking multiple slave CPUs with comparing a portion of dataset N with a portion of dataset M that the slave CPU has resources to perform within a given time; the "reports" are not sent to users, but are sent to the master CPU for concatenating into a text file identical to a *blastall* run.

As most of these "motivational" statements have little to do with the present invention, it is clear that the references were combined in hindsight to attempt to include the claimed limitations.

No Reasonable Expectation of Success

One of ordinary skill in the art could not reasonably be expected to find Applicant's claimed invention for comparing large datasets obvious in view of a plurality of references that provide no guidance on handling large datasets or processing them in parallel over a network.

All Claim Limitations Not Shown

Altschul et al. disclose the basic BLAST algorithm for sequence comparison, i.e., comparing one sequence with another sequence, or for searching a database. However, Altschul et al. at least fail to disclose or suggest dividing sequence comparison problems into discrete segments for processing on a plurality of CPUs, let alone any specific method of doing this task.

Fujimiya et al. disclose a dynamic programming method for sequence comparison for searching a database. However, like Altschul et al., Fujimiya et al. at least fail to disclose or suggest dividing sequence comparison problems into discrete segments for processing on a plurality of CPUs, let alone any specific method of doing this task.

Anderson et al. disclose a study into finding significant matches when matching DNA sequences to sequence databases, using BLAST, BLAST2, FASTA, etc. The paper does not disclose or suggest dividing sequence comparison problems into discrete segments for processing on a plurality of CPUs, let alone any specific method of doing this task.

Lincoln et al. disclose a database for storage and analysis of full-length genetic sequences. This patent does not disclose or suggest dividing sequence comparison

problems into discrete segments for processing on a plurality of CPUs, let alone any specific method of doing this task.

Further, the Examiner's interpretation of the database and external public databases as "master and slave CPUs" is entirely erroneous. The "broadest reasonable interpretation" of a claim element under M.P.E.P. §2111 must be an interpretation of the claim element, not the prior art, and must also be "consistent with the specification." In the present case, the Office Action has failed to explain in what possible manner "a method and system of storing and retrieving data from a database and external public databases" could possibly read on the claimed master and slave CPUs as claimed in claim 1:

- "sending all data elements and task definitions to a master CPU of a master-slave distributed computing platform,
 - wherein task definitions comprise at least one comparison parameter, at least one executable element capable of performing comparisons, a query data element ID/descriptor, and a subject data element ID/descriptor, and
 - wherein data elements are sent alternately from query and subject data elements;
- sending a task definition for each task from the master CPU to one of a plurality of slave CPUs when all parts of a task definition and data elements referenced by said task definition are available at said master CPU;
- sending data elements referenced by said task definition to said slave CPU;
- performing each task on a slave CPU; and
- returning task results for each task to said master CPU"

or in claim 13:

- "a master CPU of a master-slave distributed computing platform;
- a plurality of slave CPUs capable of communication with said master CPU; and
- a client CPU with instructions for:
 - dividing said query dataset N into n_N data elements having a size within a specified range;
 - dividing said subject dataset M into n_M data elements having a size within said specified range;
 - determining a number of tasks for an entire comparison of datasets N and M as $n_N \times n_M$;
 - sending all data elements and task definitions to said master CPU of a master-slave distributed computing platform,
 - wherein task definitions comprise at least one comparison parameter, at

least one executable element capable of performing comparisons, a query data element ID/descriptor, and a subject data element ID/descriptor, and wherein data elements are sent alternately from query and subject data elements;

said master CPU comprising instructions for:

 sending a task definition for each task to one of said plurality of slave CPUs when all parts of a task definition and data elements referenced by said task definition are available at said master CPU; and

 sending data elements referenced by said task definition to said slave CPU; and

said slave CPUs including instructions for:

 performing each task; and

 returning task results for each task to said master CPU."

Indeed, none of the cited prior art discloses or fairly suggests a master CPU/plurality of slave CPU's for dividing and processing a unitary sequence comparison.

Matsumoto et al. disclose biological sequence compression algorithms, but like all of the other cited prior art, fail to disclose or suggest dividing sequence comparison problems into discrete segments for processing on a plurality of CPUs, let alone any specific method of doing this task.

One reason that none of this prior art discloses or fairly suggests dividing sequence comparison problems into discrete segments for processing on a plurality of CPUs, let alone any specific method of doing this task, is because *they are not intended for comparing one database to another*, but rather for comparing one sequence to another or to a database. The prior art way of comparing a database to a database is to divide one database into sequences and then run the basic sequence-to-database comparison multiple times, possibly in parallel on multiple CPUs, as discussed by Applicant with respect to Prior Art Figure 1A. The present invention splits the problem of comparing datasets M and N into $n_N \times n_M$ comparisons of data elements from N with data elements from M, as illustrated, for comparison with Figure 1A, in Figure 1B.

As a whole, none of the cited prior art teaches or fairly suggests dividing the problem of comparing datasets M and N into $n_N \times n_M$ comparisons of data elements from N with data elements from M as presently claimed. For at least these reasons, Applicant submits that the claims are allowable over the prior art and requests reconsideration and allowance of the claims.

Conclusion

For the reasons stated above, Applicants submit that the application and claims 1-23 are in condition for allowance and respectfully requests withdrawal of all of the rejections and withdrawal of the improper election requirement due to the allowability of the generic claims. If there remain any issues that may be disposed of via a telephonic interview, the Examiner is kindly invited to contact the undersigned at the local exchange given below.

Respectfully,



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